Social Capital and Government in the Production of Public Goods

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Abstract

As a response to the rapidly growing empirical literature on social capital and the evidence of its correlation with government performance, we build a theoretical framework to study the interactions between social capital and government's action. This paper presents a model of homogeneous agents in an overlapping generations framework incorporating social capital as the values transmitted from parent to child. The government's role is to provide public goods. First, government expenditure is exogenously given. Then, it will be chosen at the preferred level of the representative agent. For both setups the equilibrium outcomes are characterized and the resulting dynamics studied. Briefly we include an analysis of the effect of productivity growth on the evolution of social capital. The results obtained caution caution against both the crowding out effect of the welfare state and the impact of sustained economic growth on social capital.

JEL classification: H41; Z13

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1 Introduction

The use of the concept of social capital in Economics is a relatively new phenomenon. A unique definition is still to come although researchers do highlight similar characteristics for the term (e.g. Paldam, 2000)[1]. One of the fathers of this literature considers social capital to be "features of social organization, such as

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[1]Some papers (eg. Rodrik (1998) and Alesina and Drazen (1991)), though, make use of the same idea but baptise it with a different name.

trust, norms, and networks, that can improve the efficiency of society by facilitating co-ordinated actions" (Putnam 1993, p.167). Note however that as the concept is defined with respect to a group/society we can think of examples such as the Sicilian Mafia where the interaction within the group has positive effects for its members (mentioned in the definition) but not so for those not belonging to the particular organization.

Social capital has been dealt with in the literature from a variety of perspectives. On one hand, studying its determinants (e.g. Glaeser et al., 2000) and on the other, analyzing the effects of its existence or level. Knack (1999) distinguishes, within the latter, two main channels through which social capital might have economic results: a microeconomic and a macro-political channel. The first, developed in papers such as Greif (1993) and Zak and Knack (2001), refers to its role as an imperfect substitute for formal institutions and therefore, for example, for reducing transaction costs.

Our paper focuses on the macro-political channel which is referred to in the existing literature as the way in which social capital can improve governmental performance and therefore, for some authors (e.g. Knack and Keefer,1997) , growth performance. Social capital is added to the list of other variables: electoral competitiveness, bureaucratic capacity, etc. (Boix and Posner, 1998), that explain the adequacy of government functioning.

Evidence supports the existence of a correlation between social capital and good government performance. Putnam (1993) analyzed this relationship for the case of Italy, finding that northern regions, those where social capital level was highest of all the country, benefitted from the most effective provision of public goods. Cross-country studies (La Porta et al. (1997) and Knack and Keefer (1997)) also sustain the same hypothesis. The two most recent, to our knowledge, empirical contributions Knack (2000) and King et al. (2002) test the relationship for the U.S. states. For example, the former finds a 0.43 simple correlation between a social capital index constructed with interpersonal trust, census mail-in response rates and volunteering, and a predictor of government performance elaborated by the Government Performance Project. This result is robust to the incorporation of other determinants and comes through even controlling for possible endogeneity problems.

A step further is to establish how the relationship comes about. Boix and Posner (1998)[2] present five "microlinkages". The co-operation that results from a higher level of social capital enables a greater accountability of what is being done in the public sphere and facilitates the transmission of voters demands; preferences will tend to be more community-orientated; government policies and regulations will be enforced more easily therefore reducing their costs; bureaucracy efficiency will increase as those who are part of it also live within the same society; and agreements in the political sphere will be more easily reached.

Except for the first two, the rest of the "microlinkages" point to how social capital enhances government's productivity, what Putnam (2000) calls the "supply side of government". We are interested precisely in this aspect. As was already mentioned, Putnam (1993) presents a case study on this issue. Narayan and Pritchett (1997) elaborate a detailed study on Tanzania's income and social capital situation. Their results give a high quantitative magnitude to the impact of social capital on household

[2]Knack (2000) also describes some of these channels.

expenditure (their measure of income) and identify as one of the channels between the two, the better publicly provided services.

The existing economic literature is mainly either fully empirical or consists of a dissertation over the concept without formalization model. Some of the exceptions are Alesina and Drazen (1991)[3], Bisin and Guaitoli (2002) and Rodrik (1998) from a macro-political perspective and François and Zabojnik (2002), Routledge and Von Amsberg (2002) and Zak and Knack (2001) from a micro perspective. They relate social capital to diverse issues such as economic development, stabilization, modernization and growth. Our paper presents a theoretical framework in which we study the interactions between social capital and government expenditure through the provision of public goods.

Part of our work tries to shed some light on the debate on the crowding out effect of the size and growth of the welfare state on the U.S. level of social capital. Putnam (2000) mentions this controversy and takes a stand in favour of other explicatory variables for the decreasing trend in the American social capital levels since the mid-sixties. He bases his argument on data of the evolution of government variables such as its size or spending.

The study of the interactions between social capital and government performance is important. They can have normative implications for developing countries which find themselves at a different stage in the evolution of their social capital stocks and in their government configuration relative to developed countries. If, as it is generally admitted, social capital is an asset for a country[4], as well as good governance, their optimal combination should be sought.

For the case of developed countries, we have mentioned how the U.S. has experienced a decrease in this type of capital. If we agree that social capital has effects on other macroeconomic variables, the study of potential explanatory factors of this trend is the first step to finding solutions to wider problems. In the case of the European Union social capital research is not as advanced. The idea behind the pioneering work on Italian regions by Putnam et al. (1993) has only been continued very recently for other countries and not focussing exclusively on the interrelationship government-social capital (Putnam, 2003). There has also been an interest in establishing the effects of social capital on economic regional growth (Beugelsdijk and Van Schaik, 2001). Social capital - government performance could be a new direction for empirical work with, for example, implications in the allocation of the European structural funds.

In summary, we are interested in the macro-political channel that links social capital with government performance. More precisely, in how a more tight-knit society will enhance government's efficiency in the provision of public goods, an aspect which has been shown to be empirically important and which can have relevant policy implications.

For this, our paper presents a model of homogeneous agents in an overlapping generations framework. As an intermediate step we solve for the equilibrium in the case of exogenous government expenditure. This allows us next to present a more comprehensive model in which it is the government who takes the

[3] For Knack (2000) this paper is the only theoretical one within the macro-political branch. Worth noting that the authors do not make explicit reference to the term "social capital".

[4] At least in most of its manifestations.

decision on its expenditure by taking into account voters' preferences. The equilibria will be analyzed in detail with the objective of determining the long run evolution of the economy and the relationship between the private and public sphere. Briefly we also consider the possibility that productivity growth could be explaining social capital dynamics.

Both for the case of exogenously given government expenditure and for the "voted" level, there exists a steady state value for the aggregate social capital stock to which the economy converges in a monotonic or oscillatory way. Uniqueness will also hold but with some additional conditions for the latter case. An exogenously increasing government expenditure is eventually accompanied by a fall in the social capital stock down to a certain positive value. When government expenditure is the solution to a policy problem, utility functions are logarithmic and the public goods' production function is Cobb Douglas, an increase in the aggregate social capital stock leads to a higher government expenditure[5].

The model has the following main assumptions that capture the intrinsic characteristics of social capital:

a) social capital has a positive effect on government's provision of public goods (which has been thoroughly justified above).

b) social capital's micro foundation. The agent will invest in social capital because she values per se her child's level of social capital tomorrow. Social capital, interpreted as norms, values and attitudes, is transmitted from parent to child and accumulated through both the parent's contribution and the society's impact.

c) externalities are present in this model yet the way they have been built in give some non-standard results. When a parent makes the social capital investment decision, she knows she will benefit from it by the direct effect it has on her child's social capital next period (which enters the parent's utility function today). But our assumed form of family altruism (called by Bisin and Verdier (2000) " imperfect empathy") is a way of reflecting the externalities inherent to social capital. The private return to this investment is lower than the social return because the individual contribution increases tomorrow's capital stock as well as the level that all future generations enjoy. If instead of just introducing tomorrow's individual level of social capital in today's parent utility function, we had incorporated the welfare of her child, as this is affected by the parent's grandchildren and so on, the externality would be internalized.

Given the externality, what can the government do to internalize it? It could establish a subsidy to the investment in order to raise it to its efficient societal level. But to finance the subsidy, taxes have to be increased. Parents are being taxed to pay for an investment whose positive effects fall on future generations only. In other words, their children would be willing to be taxed in order for their parents to be subsidized. The problem is that our definition of a given generation has children living one period and not working, thus, they cannot be taxed and parents being already dead when their descendents earn labour income. Therefore, for this specific framework, dynamic externalities cannot be corrected with intergenerational transfers. This implies that the government's policy problem is also the first best for the current generation.

In the next section, we develop our model, first, for an exogenously given government expenditure

[5] This result is valid for a wider range of economies. Details are presented in the section 2.2.

and second, endogenously determining its level. In both cases we characterize the solution, define the equilibrium and discuss the dynamics. Section 3 introduces productivity growth in the most simple manner. Section 4 contains the concluding remarks and directions for future research.

2 The Model

The economy is populated by a continuum of identical agents who live for two periods in an overlapping generations setting. The representative agent is taken to be a child during the first period and a parent in the second. During childhood no economic decisions are taken. The parent is endowed with a unit of time. She decides how to divide it between working in the labour market at a given wage rate ω or spending her time with her child in order to socialize her.

Preferences of all adult agents are given by

$$U(c, x, s') = u(c) + \pi_1 v(x) + \pi_2 z(s'), \tag{1}$$

where c is the consumption of the parent, x is the level of public goods provided by the government and enjoyed by the parent and s' is the social capital level her child will have next period when she becomes a parent herself.[6] The utility function U is additively separable. Each term, $u(c)$, $v(x)$ and $z(s')$, is twice continuously differentiable and satisfies $u'(c) > 0$, $u''(c) < 0$, $v'(x) > 0$, $v''(x) < 0$, $z'(s') > 0$ and $z''(s') < 0$. Moreover, the following Inada conditions hold: $\lim_{c\to 0} u'(c) = \infty$, $\lim_{c\to\infty} u'(c) = 0$, $\lim_{x\to 0} v'(x) = \infty$, $\lim_{x\to\infty} v'(x) = 0$, $\lim_{s'\to 0} z'(s') = \infty$, $\lim_{s'\to\infty} u'(s') = 0$. The weights π_1 and π_2 take strictly positive values.

Note that we are assuming an imperfect form of empathy as in among others Bisin and Verdier (2000). A parent chooses to invest in her child's level of social capital deriving utility from this. As we are assuming paternalistic altruism, the evaluation of the child's level of social capital is done through the parent's own preferences and not through those of her descendent. This form of altruism is supported by numerous evidence presented in papers such as the above.

We want to focus on a particular aspect of social capital, that of norms, values and attitudes that facilitate collective action. We leave aside for further work, network or trust issues also comprised in the concept. It is intuitive to see that these particular aspects of social capital are to be built in part as the result of the rational decisions made by the parent.[7] This is known as "vertical transmission". Additionally, and as one of the characteristics which differentiates social capital from other forms of capital, the child is as well influenced by the environment in which she grows up in (known as "oblique socialization").[8] Following Bisin and Verdier (2000a,b,c, 2001) and justified by biology and sociology literature, we assume a substitutability relationship between both influences. The higher the level of social capital in the society, the less personal effort the parent needs to put in to achieve a certain

[6] For notational simplicity we do not include time indices but instead make use of prime to denote period t+1.

[7] The alternative approach, evolutionary mechanism models, is based on genetic transmission and focusses exclusively on pecunary results. Yet for us when social capital is considered, fitness is not only important but also the behavioural dispositions of the parent. This ch might even lead to the opposite results to the ones driven only by economic returns.

[8] Social capital has also been modeled as an investment decision in a recent paper by Glaeser et al. (2002) but misses the role played by the society in the determination of the individuals' social capital.

socialization threshold for her child.[9] According to these guidelines (cf. Bisin and Guaitoli (2002)), social capital accumulation is carried out in the following way:

$$s' = \mu a + (1 - \delta)S, \tag{2}$$

where μ is the parameter that translates the time effort made by parents into "units" of social capital ($\mu > 0$) and δ is the linear depreciation rate ($0 < \delta < 1$); a is the socialization decision made by the parent and S the aggregate level of social capital present in the environment where the child grows up. Therefore, the social capital level the child will be endowed with next period, s', is a function of the investment made by her parent today and of the current stock of aggregate social capital.

In this economy firms are identical and we assume they produce with the following constant returns to scale technology:

$$y = Al, \text{ with } A > 0, \tag{3}$$

where l is the unique input, hours of work, A is total factor productivity and y is the resulting output.

The government produces public goods from which agents derive utility $v(x)$. The level of public goods in the economy is given by

$$x = x(g, S), \tag{4}$$

where g is the expenditure borne by the public sector. The public goods' production function satisfies $x_g(g, S) > 0$ and $x_S(g, S) > 0$, where the subindexes denote the variable with respect to which the partial derivative is taken. These properties are justified by the empirical work presented in the Introduction. Government expenditure is financed through lump sum taxes.

2.1 Exogenous government expenditure

First, we consider the case for which government expenditure is exogenously given. In the following section, its level is chosen by the government himself according to the preferences of the representative agent which is the median voter.

Each of the agents in the economy solves its maximization problem. The representative firm chooses her demand of hours of work l to maximize profits

$$\Pi = Al - \omega l, \tag{5}$$

where ω is the wage rate. At $\omega = A$ labour demand is infinitely elastic. The equilibrium units of labour l are given by the representative agent's problem for this wage rate.

The government supplies public goods whose level is given by g and S via its production function (4). Revenue is raised with lump sum taxes. The government will balance its budget constraint every period

$$g = T. \tag{6}$$

[9] Even for a more general formulation, results are still valid. See Appendix for details.

The representative agent's budget constraint is given by

$$c = (1-a)\omega - T, \tag{7}$$

where T are the lump sum taxes collected to finance the provision of public goods. Note that in our formulation we are assuming social capital is built thanks to time spent by the parent socializing her child since the transmission of values is considered a time consuming activity. The remaining time is spent working, thus the opportunity cost of socialization is the parent's foregone wage ω.[10]

Given S, g and T the representative agent chooses $\{c, a, s'\}$ such that the following optimization problem is solved:

$$Max\ \{u(c) + \pi_1 v(x) + \pi_2 z(s')\},$$

$$subject\ to\ c = (1-a)\omega - T, \tag{7}$$

$$s' = \mu a + (1-\delta)S, \tag{2}$$

$$x = x(g, S), \tag{4}$$

$$0 \leqslant a \leqslant 1,\ c \geqslant 0,\ s' \geqslant 0.$$

Substituting the constraints and solving the problem with respect to a, gives the first order condition

$$\pi_2 \mu z' \left[\mu a^* + (1-\delta)\, S\right] = u' \left[(1-a^*)\, \omega - T\right] \omega. \tag{8}$$

The left hand side of equation (8) collects the marginal benefit which is decreasing in a. On the contrary, the right hand side of the same equation that represents the marginal cost associated to the investment problem, is increasing in a and goes to infinity as a tends to one. It follows that, this problem has a unique solution $a^* \in [0, 1)$.

We are interested in how the investment choice in social capital $a^*(T, S)$ is affected by changes in the level of government expenditure, g, in the level of lump sum taxes, T, and in the stock of aggregate social capital, S. Note how the first variable has no effect on the parent's socialization decision but it

[10] Alternatively, investment in social capital could have costs in terms of goods, for instance, admission fees in a school with certain behavioural rules. For this case, the consumer's disposable income is split between consumption of private goods and investment in social capital, therefore being the agent's budget constraint

$$c + a = \omega - T. \tag{7a}$$

We will work out the model for (7). In either case results would not change qualitatively (in fact with (7a) the derivation would even be simpler).

does on the level of public goods. The investment choice in social capital depends negatively on the rest of variables. This can be seen by implicitly differentiating (8) with respect to T and S

$$\frac{da^*}{dT} = \frac{-u''(c^*)\,\omega}{u''(c^*)\,\omega^2 + \pi_2 z''(s'^*)\,\mu^2} < 0,$$

$$\frac{da^*}{dS} = \frac{-\pi_2\mu(1-\delta)z''(s'^*)}{u''(c^*) + \pi_2\mu^2 z''(s'^*)} < 0.$$

A higher tax burden reduces consumption and so the alternative use of income becomes relatively more costly. For the case of a variation in S, a higher stock of aggregate social capital reduces the incentives the parent has to increase its individual investment.

2.1.1 The equilibrium and its dynamics

Definition 1 *Given the initial condition S_0 and the exogenous sequences $\{g_t\}_{t=0}^{\infty}$ and $\{T_t\}_{t=0}^{\infty}$, an equilibrium is a sequence of allocations $\{l_t,\, x_t,\, y_t,\, c_t,\, a_t,\, s_{t+1}\}_{t=0}^{\infty}$ and price $\{\omega_t\}_{t=0}^{\infty}$ such that for all periods we have that*

(i) given ω_t, g_t, T_t and S_t, the allocation $\{c_t, a_t, s_{t+1}\}$ solves the representative agent's problem,

(ii) given ω_t, the allocation $\{y_t, l_t\}$ solves the representative firm's problem,

(iii) given g_t, the government balances its budget constraint, that is, $g_t = T_t$,

(iv) $y_t = c_t + g_t$,

(v) $l_t = 1 - a_t$,

(vi) $s_{t+1} = S_{t+1}$.

In equilibrium the social capital formation function (2), rewritten to explicitly capture the role of the state variable S and the exogenously given T, becomes

$$S' = \mu a^*(S,T) + (1-\delta)\,S. \tag{9}$$

Proposition 1 *There exists a locally asymptotically stable steady state.*

Proof. The characterization of the solution $a^*(S,T)$ allows us to prove existence, uniqueness and asymptotic stability of the steady state. Taking into account the strictly positive value of the parent's investment in social capital given a zero-valued social capital stock ($a^*(0,T) > 0$), the evolution of the aggregate stock of social capital always above the non-depreciated amount ($S' \geqslant (1-\delta)\,S$, for all $a^*(S,T)$), the continuity of the social capital formation function in equilibrium ($a^*(S,T)$ is trivially continuous) and its slope less than unity $\left(\frac{dS'}{dS} = \mu\frac{\partial a^*(S,T)}{\partial S} + (1-\delta) \leq 1,\ \text{for all } S\right)$ it can be shown there exists a unique intersection with the 45^oline such that $S' = S = S^*$. Asymptotic stability is guaranteed by the latter condition. ■

Over time the economy converges to its steady state level. Convergence can be monotonic or oscillatory depending on the slope around the steady state value S^*. For example, if the slope at S^* is positive and $S' \leqslant S^*$ for all $S \leqslant S^*$, convergence is monotonic (see Figure 1); if instead the slope is negative, convergence will be oscillatory.

<Insert Figure 1>

Example 1 Let us solve our problem for the case that $u(c)$, $v(x)$ and $z(s')$ are logarithmic. The representative agent's choice is

$$a^*(T,S) = \frac{\pi_2}{1+\pi_2} - \frac{\pi_2}{1+\pi_2}\frac{T}{\omega} - \frac{(1-\delta)}{\mu(1+\pi_2)}S, \tag{10}$$

and the evolution of the social capital stock is given by the following equation for which it is easy to check we have monotonic convergence

$$S' = \mu\frac{\pi_2}{1+\pi_2}(1-\frac{T}{\omega}) + \frac{\pi_2}{1+\pi_2}(1-\delta)S. \tag{9'}$$

2.1.2 Dynamic effects of changes in government expenditure

As was mentioned in the Introduction, some researchers blame the expansion of the welfare state for the observed decrease of the U.S. social capital stock since 1965. In fact, it is a widely supported hypothesis across the whole political spectrum world wide regardless of having no empirical support (Putnam, 2003). If we consider government expenditure as a measure of this greater intervention, we could analyze whether this hypothesis is supported or not by our model.

The long run effects of changes in the tax level are described in the next Proposition which follows immediately from differentiating equation (9) evaluated at $S = S' = S^*$ and making use of the characterization of $a^*(T,S)$.

Proposition 2 *The steady state value of the aggregate social capital stock S^* is decreasing in the tax level T.*

The short run effects of tax level changes on the aggregate social capital stock do not always coincide with the long run effects. The following proposition characterizes the short run dynamics:

Proposition 3 *Given a tax level $\overline{T}$, for any aggregate social capital stock level below (above) the steady state level, $\overline{S} < S^*$ ($\overline{S} > S^*$), next period's aggregate social capital stock will be greater (smaller) than today's, $S' > \overline{S}$ ($S' < \overline{S}$).*

Proof. Consider an aggregate social capital stock level $\overline{S}$ such that for a given tax level $\overline{T}$, it is below (*above*) its steady state value denoted by S^*. Evaluating equation (2) for both stocks and proven the magnitude and the sign of relationship between parent's investment in social capital and its level ($\frac{da^*}{dS}$), we can derive the following inequality:

$$S^* = \mu a(S^*,\overline{T}) + (1-\delta)S^* > (<)\mu a(\overline{S},\overline{T}) + (1-\delta)\overline{S} = S'.$$

Therefore, S will be increasing (*decreasing*) over time. ■

The previous proposition tells us that the long run and short run behaviour of the aggregate social capital stock need not be the same for all its levels . The phase diagram in Figure 2 illustrates this. The

SS' curve represents the points in the (S,T) space such that the aggregate social capital stock remains constant over time, that is, $S' = S$. Wage rate ω is the upper bound that we impose on T.[11] Thus, for the problem in which government's action is exogenously determined, an increasing trend in public expenditure is eventually accompanied by a fall of the social capital stock.

<Insert Figure 2>

2.2 Endogenous government expenditure

In what follows we consider the case in which government expenditure is a choice variable. We first analyze the consequences of this new setting for the problem of both the representative firm and agent and then describe the new optimization problem for the government.

All but the government, solve the same problem as in the previous section. In the new set-up, though,candidates for government choose the tax level that will maximize their chance of being elected within a majoritarian voting model. Voters, the adult agents, share identical preferences so that if they are single peaked, the median voter theorem holds. This implies that, it will be the representative agent's preferred policy the one that will be implemented by the incumbent government.

Given S, the government chooses $\{g, T\}$ such that $0 \leq T < \omega$ solve the following problem:

$$Max\ \{u(c) + \pi_1 v(x) + \pi_2 z(s')\},$$

$$subject\ to\ c = (1 - a^*)\omega - T, \tag{7'}$$

$$s' = \mu a^* + (1 - \delta)S, \tag{2'}$$

$$x = x(g, S), \tag{4}$$

$$g = T, \tag{6}$$

$$a^* = a(T, S). \tag{11}$$

In contrast to the original formulation, in this problem the amount of public goods provided x, is determined within the model and the solution to the representative agent's problem (11) is included as a constraint. Public spending is financed exclusively through lump sum taxes.

Solving the maximization problem with respect to the tax level, T, after substituting the constraints, gives the following first order condition:

$$\pi_1 v'[x(T^*, S)]\frac{\partial x}{\partial T} = (1 + \omega\frac{\partial a^*}{\partial T})u'[(1 - a^*)\omega - T^*] - \pi_2 z'[\mu a^* + (1 - \delta)S]\mu\frac{\partial a^*}{\partial T}. \tag{12}$$

The next step is to determine whether effectively a solution T^* exists. It can only be guaranteed assuming additional characteristics on the functional forms. This leads us to consider the following example as the benchmark case for which we will carry out as detailed an analysis as possible and thereafter extrapolate the results.

[11] This is necessary to guarantee a positive consumption.

Example 1 (continued) The simplified endogenous government expenditure problem consists in maximizing $\{\log(c)+\pi_1\log(x)+\pi_2\log(s')\}$ subject to all the above constraints (2'), (4), (6) and (7') evaluated at the a^* (see (11)) from the representative agent's problem. The first order condition is now[12]

$$\pi_1\frac{1}{x(T^*,S)}\frac{\partial x}{\partial T}=\frac{1}{(1-\frac{\pi_2}{1+\pi_2}+\frac{\pi_2}{1+\pi_2}\frac{T^*}{\omega}+\frac{(1-\delta)}{\mu(1+\pi_2)}S)\omega-T^*}(1-\frac{\pi_2}{1+\pi_2})+$$

$$+\pi_2\mu(\frac{\pi_2}{1+\pi_2}\frac{1}{\omega})\frac{1}{\mu(\frac{\pi_2}{1+\pi_2}-\frac{\pi_2}{1+\pi_2}\frac{T^*}{\omega}-\frac{(1-\delta)}{\mu(1+\pi_2)}S)+(1-\delta)S}. \tag{13}$$

Despite the use of a particular functional form a closed-form solution for T^* is still unworkable. Nevertheless we will check its effective existence qualitatively.

There is a well-defined solution whenever, as we saw for our exogenous government expenditure problem, the marginal benefit is decreasing in the tax level T and the marginal cost is increasing in the same variable. The latter condition always holds for the logarithmic utility case. An increasing marginal cost is also the case for those functional forms that result in an effect of T on a independent of the former's level, that is $\frac{\partial^2 a}{\partial T^2}=0$.[13]

As long as the production of public goods does not exhibit excessively strong increasing returns in government expenditure g, the marginal benefit is decreasing. That is, we have two potentially opposed forces at work on the marginal benefit: one on the marginal utility of the level of public goods x, and the other, on the marginal productivity of the tax level T. The first is affecting negatively the marginal benefit because the production of public goods is an increasing function of government's expenditure/tax revenue and the utility function $v(x(g,S))$ is concave. Note that this negative channel is independent of the specific utility functional form assumed and depends rather on the assumptions on v' and v''. What matters in signing the second force is the characterization of the public goods' production function. From the start we have assumed that its partial derivatives with respect to both of its arguments were positive, that is, $\frac{\partial x}{\partial g},\frac{\partial x}{\partial S}>0$. We now suppose as well how its second derivatives behave. If $\frac{\partial^2 x}{\partial T^2}\leqslant 0$, the marginal benefit function is decreasing in the tax level T. Otherwise, the final sign will depend on which effect dominates: the marginal utility one or marginal productivity one.

A special case for which all the above reasoning is unnecessary is if we assume a Cobb Douglas public goods production function $x(g,S)=g^\alpha S^\beta$. Figure 3 illustrates this example. With this specific multiplicative form the opposing forces just described cancel out so that there is no need to make additional assumptions on the returns to government expenditure g.

<Insert Figure 3>

Proposition 4 *Assume the public goods' production function $x(g,S)$ is Cobb Douglas and the utility function components $u(c)$, $v(x)$ and $z(s')$ are logarithmic. Then, there exists a solution to the maximization problem, $T^*\in(0,\omega)$.*

[12] No simplifications have been carried out to keep the intuition clear.

[13] Of course, even if the latter does not hold, a positive marginal cost is still possible under more detailed conditions.

Proof. No explicit solution can be found yet existence can be proved by analyzing the first order condition (13) for $x(g,S) = g^{\alpha}S^{\beta}$.Differentiating both the marginal cost and the marginal benefit with respect to the tax level we have that the first is increasing and the latter is decreasing in T. The marginal benefit is also a strictly convex function of the tax level and satisfies that $\lim_{T\to 0} MB(T) = \infty$ and $\lim_{T\to\infty} MB(T) = 0$, where $MB(T) = \frac{\pi_1 \alpha}{T}$. The marginal cost is a strictly concave function of the tax level, its value for the zero tax level is strictly positive and $\lim_{T\to\omega} MC(T) = \Delta$, where $MC(T)$ is the right hand side of expression (13) and Δ is a positive constant. The characterization of both functions guarantees the existence of T^*. ■

The solution to the endogenous government expenditure problem, that is, the level of lump sum taxes that the government levies on the agent, has been discussed qualitatively. Next, we want to show the effect of a change in the aggregate level of social capital S on this tax level T^*.

Proposition 5 *Assume the public goods' production function $x(g,S)$ is Cobb Douglas and the utility function components $u(c)$, $v(x)$ and $z(s')$ are logarithmic. Then, the chosen tax level T^* is increasing in the aggregate social capital stock S.*

Proof. Given the existence of T^*, we implicitly differentiate the first order condition (13) for $x(g,S) = g^{\alpha}S^{\beta}$ with respect to both variables, S and T. The positive relationship follows. ■

In words, an increase in the aggregate stock of social capital S affects the chosen tax level T^* when u, v, z are logarithmic and $x(g,S) = g^{\alpha}S^{\beta}$, $\alpha, \beta > 0$ through three variables:

a) consumption c: the parent's incentive to socialize her child is smaller because now the society's impact is greater. The parent will therefore dedicate more time to work increasing as a consequence her consumption and thus reducing the marginal utility of consumption $u'(c)$.

b) next period's social capital s': the indirect negative effect is through a and has already been described in a). But there is also a direct positive effect via the non-depreciated aggregate social capital stock $(1-\delta)S$. The net effect on s' is positive, thus its marginal utility $z'(s')$ falls.

c) level of public goods x: there is an increase of both the level of public goods and of the marginal productivity of government expenditure. The resulting effect on the marginal benefit $v'(x)$ is null.

The graphical analysis has been carried out already in Figure 3 above for the technology $x(g,S) = g^{\alpha}S^{\beta}$, $\alpha, \beta > 0$. An increase in the aggregate social capital stock leads to a fall in the marginal cost, that is, a higher S implies a higher c and s' and therefore lower marginal utilities. On the marginal benefit side there are again two effects. Via the marginal utility of x, a negative one. Via the marginal productivity of T, the net effect depends on the functional form assumed for $x(g,S)$. In our case where both inputs are complements, whatever the returns to scale, the two effects on the marginal benefit cancel out so that this curve is not affected by the change in S. If we had instead considered a public goods technology in which g and S were substitutes, for example, $x(g,S) = f(g) + \phi(S)$, the marginal benefit would fall with S so that the final change in T^* would depend on the relative strength of the effects on each marginal curve.

Our result is even more general because so long as we effectively have a solution, the level of lump sum taxes set by the government will increase with the level of aggregate social capital, for the case in which the marginal utility force on the marginal benefit is dominated by the effect of the productivity force or when both of these forces cancel out. Even if the marginal utility effect is stronger, the positive relation will still be true if the change in S has a stronger net effect on the marginal cost than on the marginal benefit. This can be shown by implicitly differentiating (13) with respect to S and then signing the corresponding expressions.

The choice of the production function is largely a matter of reflecting what type of public goods we are thinking about. For pure public goods it seems reasonable to believe that the civic sphere has a complementary role to play. For those goods which are provided by the government but that are excludable and/or rival, the substitutability assumption might be more reasonable. Although the researchers that hypothesize a casual relationship between the continuous growth of the welfare state and the decline in the social capital stock do not explicitly describe what type of production function they are thinking of, this second possibility could be driving their results.

2.2.1 The equilibrium and its characterization

Definition 2 *Given the initial condition S_0, an equilibrium is a sequence of allocations $\{l_t,\ x_t,\ y_t,\ c_t,\ a_t,\ s_{t+1}, g_t\}_{t=0}^{\infty}$ and price $\{\omega_t\}_{t=0}^{\infty}$ such that for all periods we have that*

(i) given ω_t, T_t and S_t, the allocation $\{c_t, a_t, s_{t+1}\}$ solves the representative agent's problem,

(ii) the allocation $\{y_t, l_t\}$ solves the representative firm's problem and the labor market clears, i.e. $\omega_t = A_t$ and $l_t = 1 - a_t$,

(iii) given $a_t^* = a(T_t,\ S_t)$ from the representative agent's problem, $\{g_t,\ T_t\}$ solves the government's problem,

(iv) $y_t = c_t + g_t$,

(v) $s_{t+1} = S_{t+1}$.

The implied dynamics of the aggregate stock of social capital is derived analogously to the exogenous government expenditure problem. We work with the social capital formation function (2) and evaluate it at the equilibrium lump sum tax level. For clarity, we write the state variable S explicitly,

$$S' = \mu a^* \left(S, T^*(S)\right) + (1 - \delta)\, S \tag{9"}$$

Proposition 6 *Assume the public goods' production function $x(g, S)$ is Cobb Douglas, the utility function components $u(c)$, $v(x)$ and $z(s')$ are logarithmic and $A \geqslant 1$. Then, there exists a locally asymptotically stable steady state.*

Proof. Once more existence is proved making use of the strictly positive value of the parent's investment in social capital given a zero-valued aggregate social capital stock ($a^*(0, T^*(0)) > 0$) and the continuity of the equilibrium social capital accumulation function, (9").[14] note though, that while

[14] Here continuity is not as straightforward as in Proposition 1 but it is still clear to see that $a^*(S, T^*(S))$ behaves smoothly under our standard assumptions on the utility functions.

in the exogenous government expenditure the slope is always positive, when government expenditure is endogenously determined, orbiting is ruled out at least if u, v, z and the public goods' production function take the particular functional forms assumed above and $A \geq 1$. It can be checked with the following equation that the latter are sufficient condition for the slope of the social capital accumulation function to lie in the open interval $(0, 1)$:

$$\frac{dS'}{dS} = \mu[\frac{\partial a}{\partial T}\frac{\partial T}{\partial S} + \frac{\partial a}{\partial S}] + (1 - \delta). \tag{14}$$

■

Asymptotic stability also holds under other functional forms and when $A < 1$, except in the special case of the social capital formation function having a slope equal to minus one. More generally, those economies in which the effect of an increase in the aggregate social capital stock is accompanied by a not too acute rise in the tax level, have an asymptotically stable behaviour towards the steady state S^*.

For any of these cases convergence can either be monotonic or oscillatory. Its type depends on the slope of (10') around the steady state. The reasoning is analogous to the exogenous government expenditure problem. Figure 4 represents the phase diagram for a case of oscillatory convergence.

<Insert Figure 4>

3 Productivity growth

So far we have considered an economy without growth. Yet, for the last 35 years, together with the decrease in the stock of social capital and the increase of the Welfare State, the U.S. economy has experienced sustained economic growth. If we are to believe the latter trend has had some effect on our variable, an interesting extension of the model is to incorporate this feature. We do so in a simple extension that maintains the basic features of our setting. Growth is modeled as the result of an exogenously increasing productivity which translates into wage growth ($\omega = A$).

3.1 Exogenous government expenditure

An increase in the wage rate ω has two effects of opposite direction on the decision to invest in social capital a. On one hand, the opportunity cost of socializing the child rises so the parent would rather work more hours instead. On the other, as social capital is a normal good, there is a positive income effect by which her incentives to invest are higher. For the case of logarithmic utility functions, that is, $u(\cdot) = v(\cdot) = z(\cdot) = \log(\cdot)$, the latter effect dominates the former. Thus, there is a positive relationship between both variables.[15]

[15] This result is obtained by implicitly differentiating with respect to ω the first order condition of the exogenous government expenditure problem (8) when $u(c)$, $v(x)$ and $z(s')$ logarithmic

In order to establish how the social capital stock changes when the wage rate is growing over time we study the dynamics of our problem. The long run effects of changes in the wage rate follow immediately from working with the social capital formation function (10) evaluated at $S = S'$.

Proposition 7 *Assume the utility function components $u(c)$, $v(x)$ and $z(s')$ are logarithmic. Then, the steady state value of the aggregate social capital stock S^* is increasing in the wage rate ω.*

Note that Proposition 5 relies on the relationship between the social capital investment a and the wage rate ω. Therefore, the result can be generalized to all other utility functions for which the income effect of a change in ω on the investment a dominates the substitution effect.

Proposition 8 *Assume the utility function components $u(c)$, $v(x)$ and $z(s')$ are logarithmic. Then, given a wage rate $\overline{\omega}$, for any aggregate social capital stock level below (above) the steady state level, $S < S^*$ ($S > S^*$), next period's aggregate social capital stock will be greater (smaller) than today's, $S' > S$ ($S' < S$).*

Proof. Analogous to the proof of Proposition 3 but in this case for a given wage rate $\overline{\omega}$. ■

The phase diagram of Figure 5 illustrates the above Propositions. The SS' curve represents the points in the (S,ω) space such that the social capital level remains constant over time, that is, $S' = S$. Thus, for the case in which government expenditure is exogenously determined and an increase in the wage rate leads to a greater investment, productivity growth does not cause a persistent fall in the social capital stock, even though, for some initial conditions, variable S may experience a decrease in the short run.

<Insert Figure 5>

If instead we assume that a parent will lower her socialization effort when its opportunity cost is higher, it follows that the evolution of social capital will be the opposite of the one described above and captures what has been observed for the past decades in the U.S. economy.

3.2 Endogenous government expenditure. Log and Cobb Douglas case

In order to obtain as unambiguous results as possible of the effect of productivity growth on social capital behaviour over time, we carry out the analysis of the endogenous government expenditure problem for the case in which the utility function has the form $U(c, x, s') = \log(c) + \pi_1 \log(x) + \pi_2 \log(s')$ and the public goods' production function $x(g, S) = g^{\alpha} S^{\beta}$. The first step is to determine the effect of an increase in the wage rate ω on the chosen tax level T^*.

$$\frac{da^*}{d\omega} = \frac{u'(c^*) + u''(c^*)(1 - a^*)\omega}{u''(c^*)\omega^2 + \pi_2 z''(s'^*)\mu^2} > 0 \tag{15}$$

Proposition 9 *Assume the public goods' production function $x(g, S)$ is Cobb Douglas and the utility function components $u(c)$, $v(x)$ and $z(s')$ are logarithmic. Then, the chosen tax level T^* is increasing in the wage rate ω.*

Proof. The assumptions on the utility function and on the public goods' production function guarantee, see Proposition, the existence of a solution. Additionally, for these specific functional forms it can be checked, by implicitly differentiating with respect to the wage rate and the tax level, the first order condition of our problem (13), that there is a positive relationship between both variables. ■

The intuition is clear. A change in the wage rate ω has no effect on the marginal benefit of the tax level as the inputs to the public goods' production function are not directly affected by the agent's income. However, the marginal cost falls precisely because of our characterization of the utility function. That is, when $U(c, x, s') = \log(c) + \pi_1 \log(x) + \pi_2 \log(s')$ the final effect on consumption and on tomorrow's social capital level is positive. Therefore, the net effect of an increase in the wage rate on the tax level is positive (illustrated in Figure 6).

<Insert Figure 6>

Note that Proposition 9 is still true under less restrictive conditions on the functional forms $u(c)$, $v(x)$, $z(s')$ and $x(g, S)$. Recall from our discussion of the continuation of Example 1 that a solution to the endogenous government expenditure problem is dependent on not excessively strong increasing returns to government spending g in the public goods' production function and on the marginal cost being increasing. It follows that for certain specifications of $a(T(S, \omega), S, \omega)$ and/or of the relative effects on the marginal utilities $u'(c)$ and $z'(s')$, we also have the result of an increase in the tax level T induced by the rise in the wage rate ω.

Our final step to prove how the evolution of the social capital stock is affected by productivity growth is to analyze the social capital formation function:

$$S' = \mu a^*(T^*(S, \omega), S, \omega) + (1 - \delta) S. \tag{9"'}$$

Despite the use of specific functional forms for $U(c, x, s')$ and $x(g, S)$, one cannot establish whether the relationship between both variables S and g is positive or negative.[16] For example, for the logarithmic case it is straightforward to see that, as the investment in social capital made by the parent depends negatively on the ratio $\frac{T(\omega,S)}{\omega}$,[17] the total effect of an increase in ω depends on whether the induced increase in T is proportionally smaller or bigger.[18] Thus, if the net impact of a rise in the wage rate on the parent's investment in social capital is positive, that is, the direct effect is greater than the indirect

[16] Analytically, the following cases come from studying the possible signs of the slope of the SS' curve:

$$\frac{d\omega}{dS} = \frac{\delta - \mu\left(\frac{\partial a}{\partial S} + \frac{\partial a}{\partial T}\frac{\partial T}{\partial S}\right)}{\frac{\partial a}{\partial \omega} + \frac{\partial a}{\partial T}\frac{\partial T}{\partial \omega}}$$

[17] See equation (10).

[18] We may even have a more complex mixed case because $\frac{\partial T}{\partial \omega}$ may also vary with S.

effect through the higher chosen tax level, the long run and short run behaviour of the aggregate social capital stock are equivalent to the exogenous government expenditure case (see Proposition 7 and 8). If the opposite were to happen, the evolution of our variable S would coincide with the empirical data already described. Figure 7 illustrates this latter possibility where the dynamics for non-steady states (S, ω) are obtained as in, for instance, Proposition 3.

<Insert Figure 7>

Note that the above figure is also representing the dynamics of the social capital stock for the case of a negative relationship between the wage rate and the investment when the tax level is affected positively by a change in the stock.

4 Conclusion

In this paper we have presented a representative overlapping generations model of social capital and provision of public goods. As a first step, government expenditure has been taken as given and, therefore, the focus has been on the agent's decision to socialize her child. Then, assuming this choice, government's expenditure has been endogeneized. In this way we have been able to study the interactions between agents' decisions (consumption, labor supply and investment in social capital) and government's choices (provision of public goods and tax levying).

For the first case it has been shown that the economy converges to a locally asymptotically stable steady state. When we have introduced a growing government, that is, when government spending increases over time, social capital on the contrary has fallen in the long run, although for some initial conditions it has experience an initial rise.

In the endogenous government expenditure problem, the second case, commonly used functional forms, that is, logarithmic utility functions and a Cobb Douglas production of public goods, have guaranteed, with an additional technical condition, local asymptotic stability. Closed-form solutions have not been available anymore, yet their characterization have given interesting results: complementarity between the tax level and both the aggregate social capital stock and the wage rate.

Finally, in an attempt to understand the impact of sustained economic growth on the evolution of social capital, we have introduced productivity growth. Under both cases the aggregate social capital stock has increased over time. For some conditions in the endogenously determined tax level case, its theoretical behaviour does mimic what has been observed during the last 35 years in the U.S.

Although the building blocks of the model have been simple, it is of great interest the introduction of social capital. In this way we have incorporated a recent concept in Economics which has brought out much empirical work and less theoretical formalization. Therefore, its scope is wide and this paper can serve as a first approximation to the variety of topics it can be applied to.

For further work on the relationship public sector-social capital we can consider two extensions. First, a quantitative and/or experimental approach can be an additional support to our hypothesis. The main

problem with the former is the data availability. It has been collected from different sources but not always in comparable measures. Knack (2000) is a recent example of possible improvements in the determination of key variables in these type of studies for the U.S. and Beugelsdijk and Van Schaik (2001) for Europe. From the experimental point of view only partial work has been developed so far and it would have to be reinterpreted, if not rethought, to fit our model.

Second, we have considered an overlapping generations model with two-period lived agents which take decisions only in their last period alive and are socialized exclusively during their childhood. As a consequence of this structure and the dynamic character of the externalities, we could additionally defend that our equilibrium solution was Pareto efficient. This result is interesting but too specific to the design of the model. It might be worthwhile to look at how such a conclusion could or not be true under more general conditions.

5 Appendix

All our analysis so far has been based on a particular social capital accumulation process given by (2). This has been justified on evidence presented by sociologists and biologists (incorporated as well to economic literature by, for example, Bisin and Verdier (2000a, 2001)). Alternatively, one could support the existence of a different mechanism closer to the one studied in human capital literature. In this way we would be highlighting the similarities between both forms of capital in detriment of the peculiarities, already stated, of social capital.[19] Nevertheless, let us consider how, if at all, our results are affected by this new approach.[20]

Instead of assuming parent's investment as substitute to society's effect on the child's socialization, we could think that a greater complementarity between the two is best describing the transmission of values to the young. The following social capital accumulation process captures this new trait:

$$s' = Ba^{\gamma}S^{\theta} + (1-\delta)S, \tag{16}$$

where $B > 0$ and the rest is defined as previously.[21]

Incorporating (16) to the exogenous government expenditure problem we obtain the first order condition

$$\pi_2 z' \left[B(\widetilde{a}^*)^{\gamma}S^{\theta} + (1-\delta)\,S\right] B\gamma\widetilde{a}^{\gamma-1}S^{\theta} = u'\left[(1-\widetilde{a}^*)\,\omega - T\right]\omega. \tag{17}$$

[19] It might be tempting to consider both forms of capital as equivalent but the new concept of social capital has explanatory power in itself. Schuller (2000) provides the framework to study the relationship between the two. In the comparison he distinguishes four dimensions: the focus, the measures, the outcomes and the model. While human capital focuses on individual agents, social capital centers on the relationships between them within a particular context. Of course, their measures are also different. As well social capital's impact goes from the effects on economic performance to those on social cohesion while, generally, human capital's outcomes are measured in terms of income or productivity. Finally, the linearity of the human capital model is much less clear for social capital where ideally some sort of interactiveness should be included.

[20] Computational details are developed in an Appendix available from the author upon request.

[21] The social capital accumulation process used throughout the paper is a special case of this more general form, for $\gamma = 1$ and $\theta = 0$.

Note that we have a new multiplicative term which corresponds to the marginal product of the parent's investment, a. This "productivity effect" did not enter the original problem as a change in a had only a level effect on tomorrow's social capital s'. A solution to the new problem is guaranteed whenever the parameter γ is less than or equal to one ($\gamma \leq 1$). This way we are ruling out increasing returns to scale in a. The same characterization as in the first problem holds for the new chosen investment level $\widetilde{a}^*(S,T)$ at least when the parameter θ is close to zero, that is, when complementarity is not too strong. For the logarithmic case it is enough to take $\theta < 1$ to guarantee $\frac{\partial \widetilde{a}^*}{\partial S} < 0$ and $\frac{\partial \widetilde{a}^*}{\partial T} < 0$.

A small enough θ ensures, as well, that the economy will evolve to a locally asymptotically stable steady state. This is true despite the discontinuity of $\widetilde{a}^*(S,T)$ for $S = 0$ and the positive effect on the marginal productivity of increases in the aggregate social capital stock. When we redo the dynamics for an increasing government expenditure, the same results are obtained as in the original problem. Therefore, under the above set of parameter values the economy's long run behaviour for the exogenous government expenditure case remains unchanged with respect to the case in which parents and society fulfill perfect substitute roles.

When government expenditure is endogenously determined within the model the new interactions between level and productivity effects make unambiguous results more difficult to obtain.[22] We will restrict our attention to the logarithmic utility and Cobb Douglas public goods' production function example. At least for this case there is a well-defined solution. Certain parameter values guarantee that S will still increase when there is a positive variation in the tax level T. More specifically, whenever certain properties on the cross derivatives of the solution of the agent's problem $\widetilde{a}^*(T^*(S),S)$ are satisfied and the net effect of an increase in the aggregate social capital stock on tomorrow's social capital is negative or intuitively, when the marginal benefit falls (note that for the Cobb Douglas case it will not shift) but less than the marginal cost. The equilibrium analysis is still true if we assume the marginal productivity effect is not too strong.

Finally, the introduction of this more general accumulation function does not give additional insights into the role played by productivity growth in the evolution of social capital (at least for the case of exogenously determined government expenditure).

Our initial results therefore, remain qualitatively identical for a larger set of parameter values. This justifies further our use of the social capital accumulation function (2) where parental investment and the society's influence need not have any degree of complementarity.

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[22] For example, the first order condition is now

$$\pi_1 v'[x(\widetilde{T}^*,S)]\frac{\partial x}{\partial T} = (1+\omega\frac{\partial \widetilde{a}^*}{\partial T})u'[(1-\widetilde{a}^*)\omega - \widetilde{T}^*] - \pi_2\gamma BS^\theta(\widetilde{a}^*)^{\gamma-1}z'[B(\widetilde{a}^*)^\gamma S^\theta + (1-\delta)S]\frac{\partial \widetilde{a}^*}{\partial T}.$$

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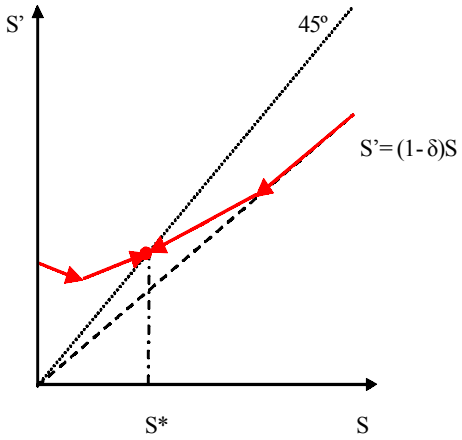

Figure 1: The Mapping $S' = \mu a^*(S,T) + (1-\delta)S$. Monotonic Convergence Example

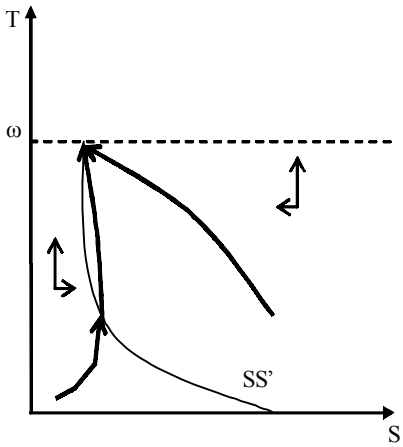

Figure 2: Dynamics for an Exogenous Increasing g

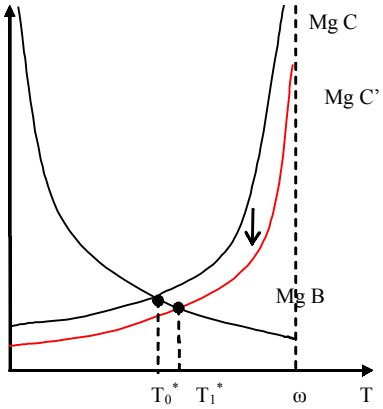

Figure 3: Effect of an Increase in S under Log Utility and Cobb Douglas Production

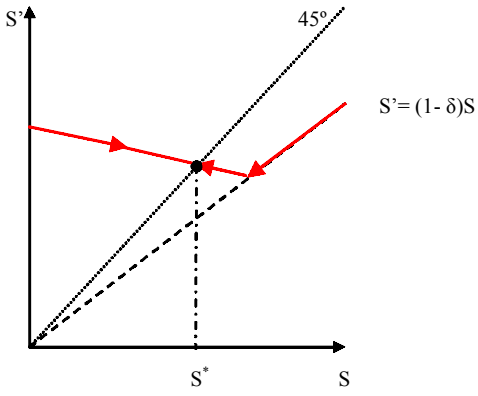

Figure 4: The Mapping $S' = \mu a^*(S, T^*(S)) + (1-\delta)S$. Oscillatory Convergence Example

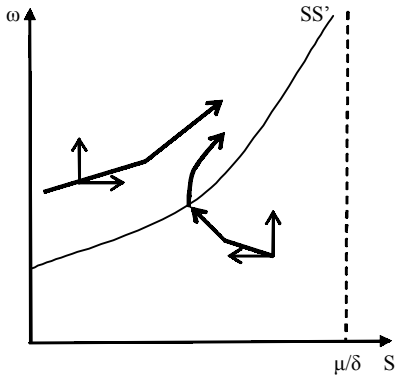

Figure 5: Dynamics for an Exogenous Increasing ω

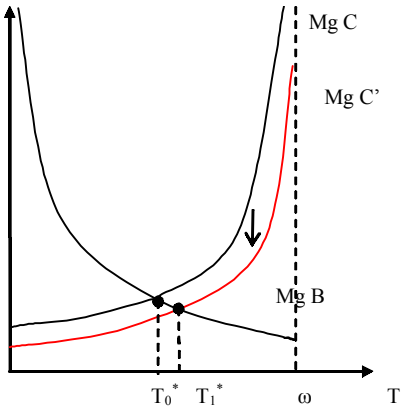

Figure 6: Effect of an Increase in ω under Log Utility and Cobb Douglas Production

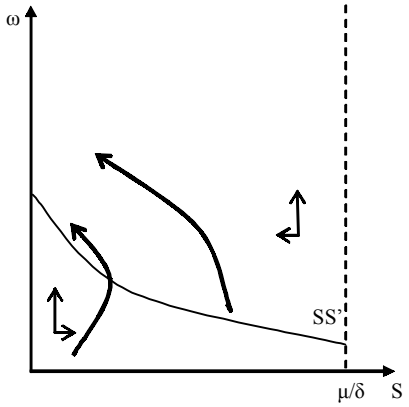

Figure 7: Dynamics for an Exogenous Increasing ω